



ASTRO-H

Instrument Calibration report
SGD Bad/Threshold
ASTH-SGD-CALDB-BADPIX

Version 0.1

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JAXA / GSFC

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Table of Contents

1	Introduction.....	4
1.1	Purpose.....	4
1.2	Scientific Impact	4
2	Release CALDB 20160310.....	4
2.1	Data Description	4
2.2	Data Analysis	5
2.3	Results	6
2.4	Comparison with previous releases	6
2.5	Final remarks.....	7

CHANGE RECORD PAGE

DOCUMENT TITLE : SGD Bad/Threshold			
ISSUE	DATE	PAGES AFFECTED	DESCRIPTION
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Introduction

1.1 Purpose

This document describes how the Bad/Threshold CALDB of the Soft Gamma-ray Detector (SGD) is prepared. The CALDB file structure is defined in the ASTH-SCT-04 and available from the CALDB web page at <http://hitomi.gsfc.nasa.gov>.

1.2 Scientific Impact

The Si and CdTe pixel-array type detectors onboard the SGD have channels with relatively lower sensitivity, or higher noise level compared to the majority of the remaining channels. In the current release of CALDB, all channels are treated as “Good” (channels defined as “Bad” are not included). In CdTe sensors, however, there are some specified channels called as “Strange”, which are ~10% of total channels in each Compton camera. Such channels have lower detection efficiency probably due to charge leakage in the electronics. Some methods to avoid the decreasing of detection efficiency due to the charge leakage are under development.

In the event reconstruction process (sgdevtid), threshold values configured for each channel are applied in order to detect valid signals emitted from each readout pixel. Signals that have energy deposits, or ADC channels more precisely, larger than the threshold defined in the CALDB will be only considered. Signals with energy deposits smaller than the threshold value will be discarded.

These Bad/Threshold conditions of the current release of CALDB are defined by using data taken in the ground experiments. If the performance of noise level in orbit makes a requirement to change the conditions, defining the Bad or Strange channels and updates of threshold values should be performed.

Release CALDB 20160310

Filename	Valid date	Release date	CALDB Versions	Comments
ah_sg1_badpix_20140101v001.fits	2014-01-01	20160310	001	
ah_sg2_badpix_20140101v001.fits	2014-01-01	20160310	001	

2.1 Data Description

Bad/Strange channels

There are no channels defined as “Bad” and “Strange” in the current release of CALDB. These channels will be defined based on the conditions of noise performance in orbit. In the CALDB file, difference flags are given to each good/bad/strange channel as shown in Table 1.

Threshold

The threshold energies contained in the current release were determined based on the noise level observed in the low temperature calibration test and the thermal-vacuum test conducted from

October 2014 to July 2015. Signals from significant noise are excluded by the threshold determined in the CALDB. While the threshold of 1 keV is given to most of channels, larger thresholds are set for the other relatively noisy channels (a few hundred channels in one Compton camera) as shown in Figure 1.

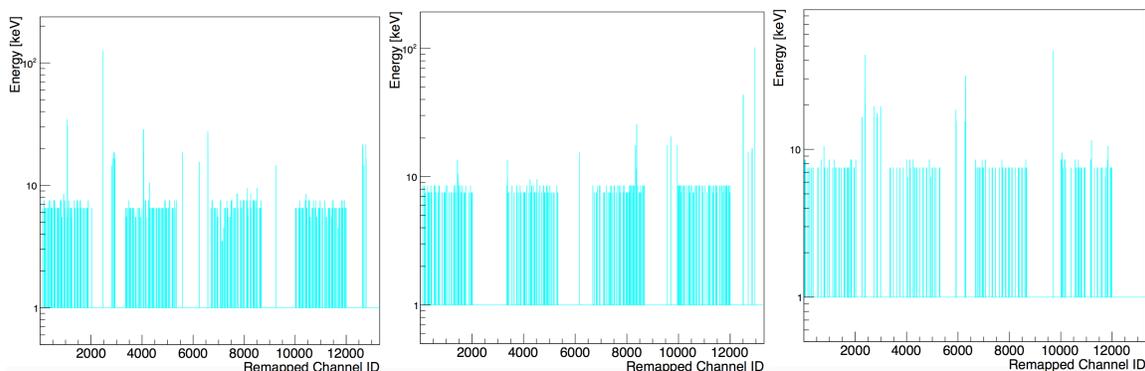
In Table 1, the column list of the CALDB is summarized.

Table 1. The column defined in the current release of CALDB

Column Name	Description
TIME	
ASIC_ID	ASIC ID
READOUT_ID	Channel ID of each ASIC
READOUT_ID_RMAP	Remapped channel ID
ACTIVE_FLAG	Flag values of each channel; Good:0/Bad:1/Strange:2
EPI_THRE	Threshold energy (keV) of each channel
ALIVE_ASIC	Number of ASIC working well
DATAMODE	

2.2 Data Analysis

The threshold was determined based on the noise performance observed in the on-ground tests. Figure 1 shows the threshold energy of all channels in the current release of CALDB. In each Compton camera, there are ~200 channels with the threshold above 1 keV.



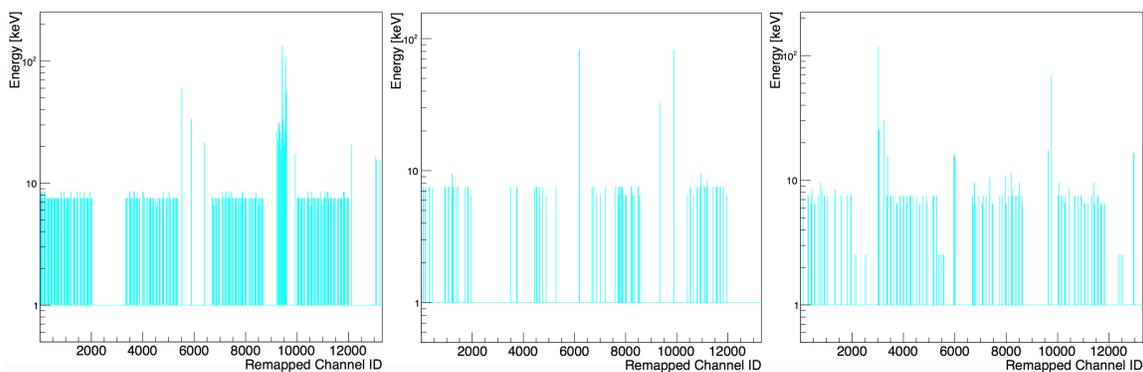


Figure 1. Threshold energy of each channel for SGD1-CC1, CC2, CC3 (top panel) and SGD2-CC1, CC2, CC3 (bottom panel)

2.3 Results

In Figure 2, the threshold distribution of each Compton camera in the current release of CALDB is summarized.

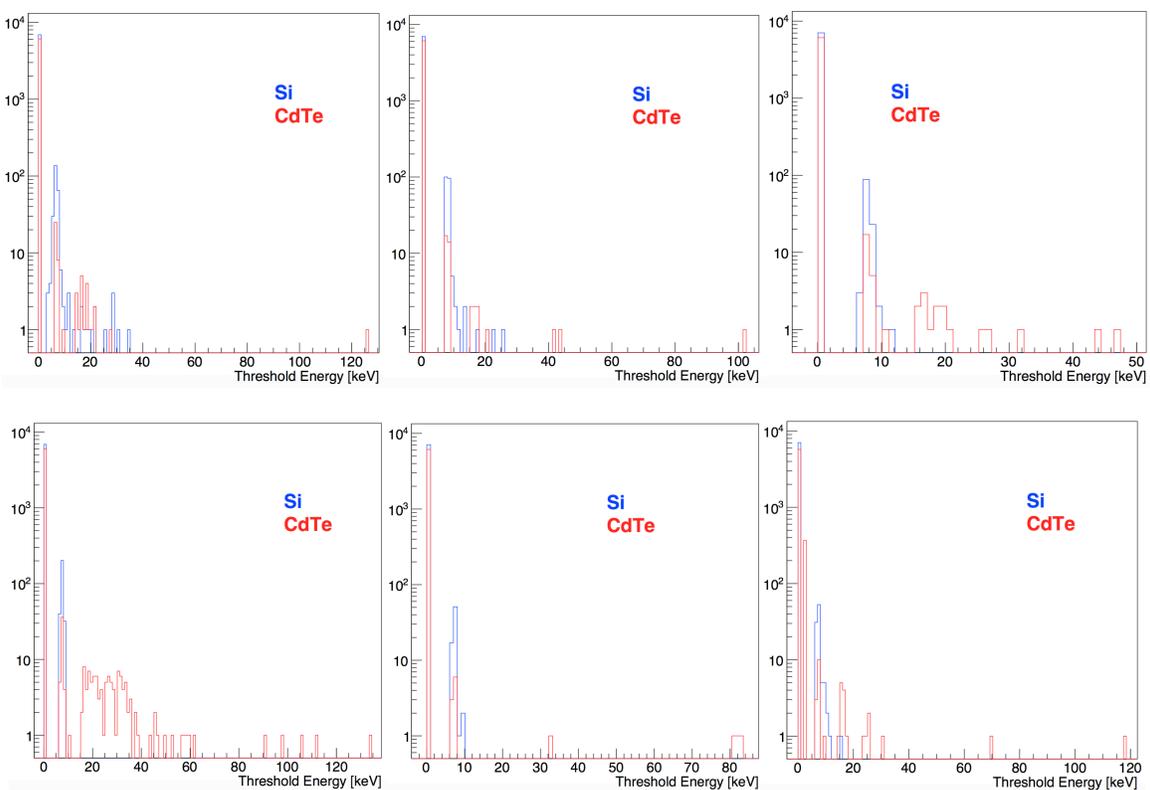


Figure 2. Threshold distribution for SGD1-CC1, CC2, CC3 (top panel) and SGD2-CC1, CC2, CC3 (bottom panel)

2.4 Comparison with previous releases

Not applicable because this is the first release of the Bad/Threshold CALDB file of the SGD.

2.5 Final remarks

The following summarize the current release of the Bad/Threshold CALDB files.

- In the current release CALDB, there are no channels defined as “Bad”. In CdTe sensors, a few hundred channels with lower efficiency are seen, called as “Strange”. These channels will be defined based on the noise performance in orbit.
- Energy threshold values were determined by using data taken during the on-ground tests. While the thresholds of most of channels are set to 1 keV, larger thresholds are set for some noisy channels. These values will be optimized based on the noise performance in orbit.